



Eur päisches Patentamt  
Eur pean Patent Office  
Office européen des brevets

Publication number:

**0 174 783  
B1**

12

## EUROPEAN PATENT SPECIFICATION

45 Date of publication of patent specification: 22.11.90

81 Int. Cl.<sup>5</sup>: H 02 K 41/025

71 Application number: 85306161.2

72 Date of filing: 30.08.85

54 Linear induction motors.

38 Priority: 13.09.84 CA 463109  
25.04.85 US 727387

43 Date of publication of application:  
19.03.86 Bulletin 86/12

45 Publication of the grant of the patent:  
22.11.90 Bulletin 90/47

84 Designated Contracting States:  
DE FR GB IT SE

56 References cited:  
DD-C- 67 169  
US-A-4 131 812

PATENT ABSTRACTS OF JAPAN, vol. 3, no. 58  
(E-111), 18th May 1979, page 104 E111; & JP - A -  
54 37207 (TOKYO SHIBAURA DENKI K.K.) 19-03-  
1979

73 Proprietor: UTDC INC.  
2235 Sheppard Ave East  
Willowdale, Ontario, M2J 5A6 (CA)

72 Inventor: Wallace, Alan Keith  
Oregon State University  
Corvallis Oregon 97331 (US)

74 Representative: Sanders, Peter Colin  
Christopher et al  
BROOKES & MARTIN High Holborn House 52/54  
High Holborn  
London WC1V 6SE (GB)

**EP 0 174 783 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European patent convention).

Courier Press, Leamington Spa, England.

## Description

The present invention relates to a linear induction motor and in particular to the primary member of such a motor.

The principle of a linear induction motor is well known and it consists basically of a primary member and a secondary member. One of the members is fixed and power is supplied to the primary member to induce an electromotive force upon the secondary member to cause relative movement between the two members. In this way motion can be obtained without the need for torque transmitting devices as used with conventional motors.

It has been proposed to use linear induction motors in a wide variety of applications and some use has been made of such motors. However their widespread use in the transportation field has been limited although considerable research and development has been conducted on such motors for this particular application. One problem encountered with the use of such motors in the transportation field is the energy dissipated as heat by the motor and the problems associated with the removal of this heat.

The primary member of such a motor usually comprises a core that carries an electrical winding. The winding has a number of turns spaced apart along the core and extending transverse thereto. Each turn has an end winding projecting laterally from opposite sides of the core, and including a knuckle portion to reverse the direction of the winding. Because of the rigorous environment in which the motors are intended to operate in the transportation field, it is necessary to protect these end windings. It is therefore found necessary to fit side cover assemblies that extend along either side of the core and encompass the end windings. A primary member of this type is disclosed, for example, in US-A-4,131,812.

Some form of cooling is generally provided for the motor winding, but hitherto the side covers have hindered cooling of the end windings with the result that exceptionally high temperatures are frequently encountered within the side cover. In order to achieve an acceptable motor life this, in turn, results in the need for a higher grade of electrical insulation on the coils. However, this leads to reduced spacing between the adjacent turns of the coil and a further hindrance to the cooling of the end windings. Thus the reliability of a linear induction motor that is intended for this particular application has been less than acceptable due to the thermally induced failures of the electrical insulation and the motor windings.

The present inventor has established that the closely spaced end windings in a primary member of the type disclosed in US-A-4,131,812 tend to dissipate the greatest proportion of energy in the form of heat. According to one aspect of the present invention the cooling means for the motor winding of the primary member is characterised in that it com-

prises a plurality of fans located on opposite sides of the core and outboard thereof for directing air through the side cover assemblies to cool the end windings.

According to another aspect of the present invention, the core is located between a pair of spaced parallel frame members and supported thereby, and the means for cooling the core and winding is characterised by a first set of cooling elements located between the frame members to extract heat from the core, and a second set of cooling elements located outboard of the frame members and to either side thereof to extract heat from the end windings.

By providing the cooling system outboard of the core of the motor it is possible to direct cooling air efficiently over the end windings of the coils and thus ensure that heat is dissipated effectively. The reduction in internal temperature encountered within the side covers reduces the operating criteria for the insulation and permits a less bulky material to be used. This increases the spacing between adjacent coils to enhance the cooling of the coils.

Preferably baffle means are provided between the side cover and the coil end turns to direct the air between the coils rather than around the ends and thereby improve the heat transfer from the coils to the cooling air.

An embodiment to the invention will now be described by way of example only in the accompanying drawings in which:

Figure 1 is a diagrammatic illustration of a linear induction motor installed on a vehicle.

Figure 2 is a perspective view of the underside of the primary member of the motor shown in Figure 1 with portions removed for clarity.

Figure 3 is a perspective view from above of the frame used in the primary member shown in Figure 2.

Figure 4 is a perspective view showing a portion of the frame shown in Figure 3 with covers fitted.

Figure 5 is a side view of the primary member shown in Figure 2.

Figure 6 is an enlarged view of a portion of the core shown in the side view of Figure 5.

Figure 7 is a section of one of the windings shown in Figure 6 on an enlarged scale.

Figure 8 is a section on the line 8—8 of Figure 5.

Figure 9 is a section on the line 9—9 of Figure 8.

Figure 10 is a plan view of the primary member shown in Figure 2.

Figure 11 is a section on the line 11—11 of Figure 10.

Figure 12 is a section on the line 12—12 of Figure 10.

Referring to Figure 1, a vehicle 10 is supported on a truck 12 that is guided by a rail track 14. The truck 12 carries the primary member 16 of a linear induction motor that receives power from a way-side rail 18 through a pickup 20. A secondary member 22, commonly referred to as a reaction rail, is located between the rails 14 beneath the primary member 16. Upon the application of

power to the primary member 16 a thrust is developed between the reaction rail 22 and the primary member 16 to propel the vehicle along the rail 14.

The details of the primary member 16 can best be seen in Figure 2. The primary member 16 comprises a frame 24 that supports a central core 26. A winding 28 is arranged on the core and projects laterally to both sides of the core. A side cover assembly 30 is mounted on the frame 24 and encompasses the portions of the winding projecting laterally from the core 26.

The frame 24 can best be seen in Figures 3 and 5. The frame 24 comprises a pair of spaced parallel frame members 32 that extend between outboard and inboard end plates 34, 46 respectively. Each of the end plates 34, 46 extends above and below the frame members 32 and an upper horizontal plate 36 projects from the upper edge of end plate 34. A skirt 38 depends from the horizontal plate 36 to form a housing 40. Located within the housing 40 and secured thereto are a pair of scraper blades 42 that project below the housing 40 to remove debris from the reaction rail 22.

A horizontal plate 44 (Figure 5) is welded to the inboard end plate 46 and has a skirt 48 depending therefrom. The skirt and end plate define a hollow housing 50 through which electrical cables may be run between opposite sides of the primary member.

A pair of suspension brackets 52, 54 are mounted at opposite ends of the frame members 32 adjacent the inboard and outboard end plates 46, 34 respectively. The suspension brackets 52, 54 are in the form of castings and the bracket 52 has a pair of longitudinally extending webs 56 that each receive a spherical bearing 58. The bracket 54 has a generally transverse web 60 that extends between and projects to either side of the frame members 32. A spherical bearing 62 is received in the web 60 between the frame members 32 and similar bearings 64, 66 are received in the web 60 on either side of the frame members. The bearings 58, 62, 64 and 66 provide suspension points to connect the frame and thereby the primary member to the underside of the truck 12.

Thrust from the primary member to the vehicle is transmitted through a bracket 68 that is located between the frame members 32. The bracket 68 has an upstanding clevis 70 that is connected to a suitable point on the truck to transmit thrust between the truck and the motor.

Projecting laterally from the frame members 32 are a plurality of outriggers 72 each of which has a generally triangular shape with a horizontal upper surface 74 and a pair of downwardly inclined lower surfaces 76, 78 respectively. A stringer 80 is welded to the terminal portion of each of the outriggers 74 to extend generally parallel to the frame members 32 between the outriggers. An angle member 82 is also welded to the stringer 80 on the side opposite to the frame member 32 and extends beyond either end of the stringer to the end plates 34, 36. The angle member 82 serves as an abutment to the side cover assembly 30.

An elongate tubular support member 84 is welded to the outriggers 72 at the junction between the lower surfaces 76, 78 to extend generally parallel to the frame members 32 between the end plates 34, 46. The support member 84 provides a support for the lateral portions of the windings that extend beyond the core 26.

As shown in figures 2, and 5 through 9, the core 26 is laminated from a plurality of thin vertical plates 88 that extend generally parallel to the frame members 32. The plates 88 are formed from magnetic steel having an insulating coating on each exterior surface. The plates 88 are located between the frame members 32 and are secured to one another and to the frame members by tie bolts 89. Each of the plates 88 projects below the lower edge of the frame members 32 and has teeth 90 depending therefrom to define a plurality of transverse slots 92. The teeth 90 are undercut on their vertical edges adjacent the lower ends thereof to provide a dovetail groove 94.

Each of the slots 92 receives a portion of the winding 28. The winding consists of a number of coils 96 which have a pair of generally parallel portions 98 interconnected by an end winding 100. The end winding 100 is bent as indicated at 102 (Figures 2 and 8) to provide a knuckle that reverses the direction of the coil. The parallel portions 98 are spaced apart along the longitudinal axis and are received in corresponding slots 92. The plane of the coils 96 is inclined to the horizontal and, except at the extreme ends of the core 26, each of the slots 92 will receive the parallel portions 98 of two coils 96 stacked one above the other. As best seen in Figure 6, to retain the parallel portions 98 in the slot 92, a wedge member 104 is provided which cooperates with the dovetail grooves 94 to prevent vertical movement within the slot. At the extreme ends of the core 26 where only one coil is received in the slots 92, a filler block is utilised to retain the coils within the slot.

A pair of liners 106, 108 are provided between the wedge and the lower surface of the coil to provide protection for the insulation on each of the coils. One of the liners 106 is formed from a material sold under the trade name NOMEX and the other liner 108 is made from a material sold under the trade name GLASTIC.

The formation of each of the coils is best seen in Figure 7. Each coil 96 consists of a plurality of turns of a conductor 110 with successive turns insulated from one another. The conductor 110 is of generally rectangular cross-section and the successive turns are stacked relative to one another to form a generally rectangular cross-section for the conductor. Each of the turns is wrapped in a layer of 5 mil dacron tape 116. The turns 110 are stacked in two arrays side by side and separated by a spine 114 made from NOMEX of a thickness of 20 mill. A pair of channel members 118, 120 formed from 10 mil NOMEX material are placed from opposite directions over the stacked turns 110 to provide two additional layers of insulation top and bottom and the whole assembly

then wrapped in 7 mill polyglass tape with a 50% overlap between successive passes of the tape. In this way electrical insulation between adjacent turns and between adjacent coils is provided in a compact manner.

With the coils 96 installed within the slots 92, the end winding 100 project laterally beyond the frame members 32. As can be seen in Figure 8, the end winding 100 are supported by the support member 84 that is provided with a projecting flange 120 on its underside. The end winding 100 is attached to the support member 84 by wire 122 that is wrapped around the support member 84, a Dacron pad 121 and around the coil end winding 100. Dacron spacers 123 are provided at this point between the end winding of the coils to negate vibration at the ties and consequent loosening of the support and/or wear of the insulation.

In order to protect the laterally extending end winding 100 of the coils 96 the side cover assembly 30 is fitted along the length of the primary member to encompass the end winding 100 and is best seen in figures 4 and 8. Each of the side cover assemblies 30 comprises a lower cover 124 and an upper cover 126. The lower cover 124 is supported at one end by the angle member 82 and at the opposite end by the alternate ones of the wedges 104. The upper edge 128 of the lower member 124 is bent outwardly to provide a stiffening rib and a gasket 130 inserted between the angle member 82 and the lower cover 124. Bolts 132 pass through the lower cover 124 and are threaded into the stringer 80 to secure the lower cover.

The lower cover 124 has a vertical portion 134 and a horizontal portion 136 that are interconnected by an arcuate portion 138. The upper edge 128 of the vertical portion 134 is bent outwardly to provide a stiffening rib 140 and bolts 132 pass through the upper edge 128 and into threaded holes 142 in the stringer 80 to secure the upper edge 128 of the lower cover 124. The horizontal portion 136 of the lower cover 124 is jogged at opposite marginal edges as indicated by reference numerals 146 and 148. Portions of the depressed portion 150 between the jogs 146, 148 are removed to provide an aperture 152. A mesh 154 is located within the depression 150 and covers the aperture 152 to prevent the ingress of extraneous material.

The inner edge 156 of the horizontal portion 136 is secured in a notch 158 formed on the upper surface of the wedges 104. The inner edge 156 fits between the liner 108 and the wedge 104 and is securely held without physically contacting the undersurface of the coil 96 and a sealing strip 159 (Figure 4) is located on the interior of the lower side covers at opposite ends to seal against the lower surface of end plates 34, and 36. As can best be seen in Figure 9, the wedges 104 are provided with the notches 158 at one end only. The wedges are staggered along the primary member with the notches 158 in adjacent wedges projecting to opposite sides of the core 26. In this way support is provided for opposite sides of the core 26 for each of the lower side covers 124.

The upper side cover 126 has a pair of inboard and outboard vertical flanges 160, 162 respectively interconnected by a horizontal portion 164. A gasket 166 is carried by the lower edge of the outboard vertical flange 162 and rests against the upper surface of the angle member 82. Bolts 168 pass through the outboard flange 162 and are secured to weld nuts 170 attached to the interior of the stringer 80.

The inboard vertical flange 160 is secured to the frame member 32 by bolts 172 that are received in threaded bores 174 in the frame member 32. A gasket 176 is located between the frame member 32 and the inboard flange 160 to seal the upper side cover 126. The upper side cover 126 does not extend the full length of the frame members 32 but terminates prior to the suspension brackets 52, 54. End plates 178 (Figure 4) seal the ends of the side cover and are supported on respective ones of the outriggers 72. The balance of the coils are covered by deck plates 180 that are simply planar sheets secured by set screws 182 to the outrigger and end plate 44.

To provide cooling for the turns located within the side cover assembly 30, the cooling arrangement shown in Figures 8 and 10—12 is used. Fans 183 are mounted on the horizontal portion 164 of the upper side cover 126 between the outriggers 72. Each of the fans is located beneath an aperture 184 in the horizontal portion and is secured to the horizontal portion by bolts 186. The apertures 184 are covered by expanded metal mesh 188 to prevent the ingress of extraneous material. The fans 183 are commercially available units available from Rotron and incorporate a thermal protection device to prevent overheating of the fan motor if the fan is stalled by, for example, the ingress of snow. The fans 183 draw air through the apertures 184 and blow it across the end winding 100 of the coils 96. Air is then expelled through the apertures 152 in the lower cover 124. A baffle in the form of an air dam 194 (Figure 8) is located on the arcuate portion 138 to direct air between the adjacent end winding 100 rather than around the outside of the end winding 100. The air dam is formed from a synthetic rubber strip and runs the entire length of the cover 124. It is spaced from the end coil sufficiently to avoid contact with end coil during operation, but sufficiently close to ensure that air flow between the end coil and the air dam is restricted. Typically a spacing of 3 mm has proved satisfactory.

To provide cooling for the core 26 a pair of fan assemblies 196, 198 are located between the frame members 32 above the core 26. Each of the fan assemblies 196 has a sheet metal bracket 200 to secure it to the frame members and to direct air along the upper surface of the core. Bolts 203 extend through the frame members 32 and pass through spacers 204 and into apertures in a downwardly projection flange 206 of the bracket 200. Each bracket 200 has front and rear extensions 201, 202 respectively that extend between the brackets 52—68 and 68—54 to provide a substantially continuous baffle above the core 26.

This acts to direct air along the core between the frame members 32.

During operation of the primary member electrical energy flowing to the coils produces a thrust between the primary and secondary members. The heating effect of the energy in the coils causes the temperature within the side cover assemblies 30 to increase. To avoid excessive temperatures being encountered the fans 183 provide air through the side cover assembly 30 which is directed by the baffle 194 between adjacent coils of the winding 28. This effectively maintains the temperature within the side cover at reasonable limits. The second set of cooling elements provided by the fans 196 and 198 are effective to extract heat from the core although the heat generated in this zone tends to be less than that generated in the end winding of the coils.

Air flow between the coils is facilitated by the insulation system shown in Figure 6 which provides a compact yet effective insulation to maximize the free space between the coils and increase the air flow therethrough. The side cover assemblies 30 can be readily removed for maintenance and the plurality of fans used at each side of the motor ensures continued cooling in the event that one fan fails.

#### Claims

1. A primary member (16) for a linear induction motor comprising: an elongate core (26); a motor winding (28) having a plurality of turns (96) spaced apart along said core and extending transversely thereto, said turns (96) each having an end winding (100) projecting from opposite sides of said core (26) and each including a knuckle portion (102) to reverse the direction of said winding (100); a pair of side cover assemblies (30) extending along said core (26) on either side thereof and encompassing said end winding (100); and means (183, 196, 198) for cooling the motor winding (28) characterised in that the cooling means comprises a plurality of fans (183) located on opposite sides of said core (26) and outboard thereof for directing air through said side cover assemblies (30) to cool said end winding (100).

2. A primary member according to claim 1 wherein baffle means (194) are located between said end winding (100) and said side covers (30) to direct the cooling air between the adjacent end windings (100).

3. A primary member according to claim 2 wherein said fans (183) direct cooling air from one side of a respective cover (30) to the other side and outlet means (152) are provided on said other side to permit egress of the cooling air.

4. A primary member according to claim 3 wherein each of said outlet means (152) is located opposite said fans (183).

5. A primary member according to claim 3 wherein said core is positioned between a pair of frame members (32) and each said side cover

assembly (30) is supported on a respective outrigger assembly (72) extending transversely from said frame members (32).

6. A primary member according to claim 5 wherein said fans (183) are supported by said outrigger assemblies (72).

7. A primary member according to claim 6 wherein each of said cover assemblies (30) includes first (126) and second (124) elements, each of said elements (126, 124) having one edge terminating adjacent to said core (26) and an opposite edge supported by said outrigger assembly (72).

8. A primary member according to claim 7 wherein said fans (183) are mounted on said first element (126).

9. A primary member according to claim 8 wherein outlet apertures (152) are provided on said second elements (124) to permit egress of air from said side covers (30).

10. A primary member according to claim 9 wherein said outlet apertures (152) are opposite said fans (183).

11. A primary member according to claim 10 wherein said outrigger assembly (72) includes a stringer (80) extending generally parallel to said frame members (32) and spaced therefrom and said opposite edges are connected to said stringer.

12. A primary member according to claim 11 wherein said baffle means (194) is attached to the interior of said second element (124) and extends generally parallel to said frame member (32).

13. A primary member according to claim 11 wherein said stringer (80) is connected to said frame member (32) by transverse beams and a support member (84) extends between said beams generally parallel to said frame members (32), said end winding (100) of said turns (96) being connected to said support member (84) intermediate the ends thereof.

14. A primary member according to claim 2 wherein further fans (196, 198) are located adjacent said core (26) to direct air over said core.

15. A primary member according to claim 14 wherein said core (26) is supported between a pair of frame members (32) and said further fans (196, 198) are located between said frame members.

16. A primary member (16) for a linear induction motor comprising a frame (24) having a pair of spaced parallel frame members (32), a core (26) located between said frame members (32) and supported thereby, a motor winding (28) carried by said core (26) and including a plurality of turns (96) spaced apart along said core (26) and extending transversely thereto, each of said turns (96) including a pair of parallel portions (98) supported by said core (26) and interconnected by an end winding (100) projecting beyond said core (26) on opposite sides thereof and having a direction reversing knuckle portion (102), a pair of side cover assemblies (30) extending along said core (26) on either side thereof to cover said end windings (100), and cooling means (183, 196, 198)

für die Kühlung des Kerns (26) und die Wicklung (28), charakterisiert in dem, daß die Kühlung bedeutet, daß eine erste Reihe von Kühlungselementen (196, 198) zwischen den Rahmenmitgliedern (32) zur Extraktion der Wärme aus dem Kern (26) und eine zweite Reihe von Kühlungselementen (183) außerhalb des Rahmenmitglieds (32) und auf beiden Seiten davon zur Extraktion der Wärme aus den Endwicklungen (100).

17. Ein Primäranspruch nach Anspruch 16, in dem die zweite Reihe von Kühlungselementen umfaßt einen Ventilator (183) zur Lenkung eines Luftstroms durch das Innere von jeder der Seitenabdeckungsassemblierungen (30).

18. Ein Primäranspruch nach Anspruch 17, in dem jede Seitenabdeckungsassemblierung (30) umfaßt einen Lufteinlaß (184) und einen Luftauslaß (152) auf gegenüberliegenden Seiten davon, und der Ventilator (183) Luft zum Fließen von dem Lufteinlaß (184) über die Endwicklungen (100) zum Luftauslaß (152) zwingt.

19. Ein Primäranspruch nach Anspruch 18, in dem die Ablenkungsmittel (194) innerhalb von jeder der Seitenabdeckungsassemblierungen (30) zur Lenkung der Luft über die Endwicklungen (100) angeordnet sind.

20. Ein Primäranspruch nach Anspruch 18, in dem eine Mehrzahl von Ventilatoren (183) auf jeder Seite des Kerns (26) angeordnet sind.

21. Ein Primäranspruch nach Anspruch 20, in dem die Ventilatoren (183) auf einer ersten Seite (126) der Seitenabdeckungsassemblierung (30) und der Luftauslaß (152) auf einer zweiten Seite (124) der Seitenabdeckungsassemblierung (30) angeordnet sind, wobei die Seitenabdeckungsassemblierung (30) zwischen den Rahmenmitgliedern (32) angeordnet ist, um die ersten und zweiten Seiten der Endwicklungen (100) zu verbinden.

22. Ein Primäranspruch nach einem der Ansprüche 16 bis 21, in dem der Kern (26) eine untere Oberfläche mit einer Mehrzahl von Querschnittslücken aufweist, um die Parallelportionen (98) der Wicklungsschichten (96) aufzunehmen.

#### Patentansprüche

1. Primäranspruch (16) für einen linearen Induktionsmotor, welcher aufweist: einen länglichen Kern (26); eine Motorwicklung (28), die eine Mehrzahl von Windungen (96) hat, die in einem Abstand längs des Kerns vorgesehen sind und in Querrichtung hierzu verlaufen, wobei die Windungen (96) jeweils eine Endwicklung (100) haben, die von den gegenüberliegenden Seiten des Kerns (26) vorsteht und jeweils einen Knieabschnitt (102) zur Umkehr der Richtung der Wicklung (100) haben; ein Paar von Seitenabdeckungsanordnungen (30), die längs des Kerns (26) auf jeder Seite desselben verlaufen und die Endwicklung (100) umgeben; und eine Einrichtung (183, 196, 198) zum Kühlen der Motorwicklung (28), dadurch gekennzeichnet, daß die Kühleinrichtung eine Mehrzahl von Lüftereinrichtungen (183) aufweist, die auf den gegenüberliegenden Seiten des Kerns (26) und außerhalb desselben zur Lenkung von Luft durch die Seitenabdeckungsanordnungen (30) zum Kühlen der Endwicklung (100) vorgesehen sind.

2. Primäranspruch nach Anspruch 1, bei dem eine Ablenkungseinrichtung (194) zwischen der Endwicklung

(100) und den Seitenabdeckungen (30) vorgesehen ist, um die Kühlluft zwischen die benachbarten Endwicklungen (100) zu lenken.

3. Primäranspruch nach Anspruch 2, bei dem die Lüftereinrichtungen (183) Kühlluft von einer Seite einer zugeordneten Abdeckung (30) zu der anderen Seite lenken und eine Auslaßeinrichtung (152) auf der anderen Seite vorgesehen ist, um den Austritt der Kühlluft zu ermöglichen.

4. Primäranspruch nach Anspruch 3, bei dem die Auslaßeinrichtung (152) den Lüftereinrichtungen (183) gegenüberliegend vorgesehen ist.

5. Primäranspruch nach Anspruch 3, bei dem der Kern zwischen einem Paar von Rahmenteilchen (32) liegt und jede Seitenabdeckungsanordnung (30) auf einer zugeordneten Auslegeranordnung (72) abgestützt ist, die sich ausgehend von den Rahmenteilchen (32) in Querrichtung erstreckt.

6. Primäranspruch nach Anspruch 5, bei dem die Lüftereinrichtungen (183) mit Hilfe der Auslegeranordnungen (72) gelagert sind.

7. Primäranspruch nach Anspruch 6, bei dem jede Seitenabdeckungsanordnung (30) erste (126) und zweite (124) Elemente umfaßt, jedes Element (126, 124) einen Rand hat, der in der Nähe des Kerns (26) endet und einen gegenüberliegenden Rand hat, der mittels der Auslegeranordnung (72) abgestützt ist.

8. Primäranspruch nach Anspruch 7, bei dem die Lüftereinrichtungen (183) auf dem ersten Element (126) angebracht sind.

9. Primäranspruch nach Anspruch 8, bei dem Auslaßöffnungen (152) auf dem zweiten Element (124) vorgesehen sind, um den Austritt von Luft aus den Seitenabdeckungen (30) zu ermöglichen.

10. Primäranspruch nach Anspruch 9, bei dem die Auslaßöffnungen (152) den Lüftereinrichtungen (183) gegenüberliegen.

11. Primäranspruch nach Anspruch 10, bei dem die Auslegeranordnung (72) einen Längsträger bzw. einen Gleisbalken (80) umfaßt, der im allgemeinen parallel zu den Rahmenteilchen (32) und in einem Abstand zu diesen verläuft, und bei dem die gegenüberliegenden Ränder mit dem Längsträger verbunden sind.

12. Primäranspruch nach Anspruch 11, bei dem die Ablenkungseinrichtung (194) an dem Innern des zweiten Elements (124) angebracht ist und im allgemeinen parallel zu dem Rahmenteilchen (32) verläuft.

13. Primäranspruch nach Anspruch 11, bei dem der Längsträger (80) mit dem Rahmenteilchen (32) über Querträger verbunden ist, und ein Tragteil (84) zwischen den Trägern im allgemeinen parallel zu den Rahmenteilchen (32) verläuft, wobei die Endwicklung (100) der Windungen (96) mit dem Tragteil (84) zwischen dessen Enden verbunden ist.

14. Primäranspruch nach Anspruch 2, bei dem weitere Lüftereinrichtungen (196, 198) in der Nähe des Kerns (26) vorgesehen sind, um Luft über den Kern zu lenken.

15. Primäranspruch nach Anspruch 14, bei dem der Kern (26) zwischen einem Paar von Rahmenteilchen (32) abgestützt ist und die weitere Lüftereinrichtung (196, 198) zwischen den Rahmenteilchen liegt.

16. Primärteil (16) für einen linear n Induktionsmotor, der einen Rahmen (24), der ein Paar von im Abstand angeordneten, parallelen Rahmenteilen (32) hat, einen Kern (36), der zwischen den Rahmenteilen (32) vorgesehen ist und durch diese abgestützt ist, eine Motorwicklung (28), die vom Kern (26) getragen wird und eine Mehrzahl von Windungen (96) enthält, die in einem Abstand längs des Kerns (26) vorgesehen sind und quer zu diesem verlaufen, wobei jede Windung (96) ein Paar von parallelen Abschnitten (98) umfaßt, die am Kern (26) abgestützt sind und die über eine Endwicklung (100) miteinander verbunden sind, die über dem Kern (26) an gegenüberliegenden Seiten desselben vorsteht und einen Knieabschnitt (102) zur Richtungsumkehr hat, ein Paar von Seitenabdecken (30), die längs des Kerns (26) auf jeder Seite desselben verlaufen, um die Endwicklungen (100) abzudecken und Kühlrichtungen (183, 196, 198) zum Kühlen des Kerns (26) und der Wicklung (28) aufweist, dadurch gekennzeichnet, daß die Kühlrichtungen einen ersten Satz von Kühlelementen (196, 198) aufweisen, die zwischen den Rahmenteilen (32) vorgesehen sind, um Wärme vom Kern (27) abzuführen, und einen zweiten Satz von Kühlelementen (183) aufweist, der außerhalb der Rahmenteile (32) sowie auf jeder Seite vorgesehen sind, um Wärme von den Endwicklungen (100) abzuführen.

17. Primärteil nach Anspruch 16, bei dem der zweite Satz von Kühlelementen eine Lüftereinrichtung (183) zum Lenken eines Stroms der Kühlluft durch das Innere der jeweiligen Seitenabdecken (30) umfaßt.

18. Primärteil nach Anspruch 17, bei dem die Seitenabdecken (30) einen Lufteinlaß (184) und einen Luftauslaß (152) auf gegenüberliegenden Teilen aufweist, und daß die Lüftereinrichtung (183) bewirkt, daß Luft von dem Einlaß (184) über die Endwicklung (100) zu dem Auslaß strömt.

19. Primärteil nach Anspruch 18, bei dem die Ablenkrichtung (194) jeweils innerhalb der Seitenabdecken (194) vorgesehen sind, um Luft über die Endwicklung (100) zu leiten.

20. Primärteil nach Anspruch 18, bei dem eine Mehrzahl von Lüftereinrichtungen (183) auf jeder Seite des Kerns vorgesehen ist.

21. Primärteil nach Anspruch 20, bei dem die Lüftereinrichtungen (183) an einem ersten Teil (26) der Seitenabdecken (30) angebracht sind und der Auslaß (152) auf einem zweiten Teil (124) der Seitenabdecken angebracht ist, wobei eine Auslegeranordnung (72) auf den Rahmenteilen (32) als Zwischenverbindung für die ersten und zweiten Teile außerhalb der Endwicklung (100) vorgesehen ist.

22. Primärteil nach einem der Ansprüche 16 bis 21, bei dem der Kern (26) eine untere Fläche mit einer Mehrzahl von Querschlitzen zur Aufnahme der parallelen Abschnitte (98) der Wicklungswindungen (96) hat.

#### Revendications

1. Un élément primaire (16) pour un moteur

linéaire à induction important: un noyau allongé (26); un enroulement de moteur (28) comportant une pluralité de spires (96) espacées le long dudit noyau et s'étendant transversalement à celui-ci, lesdites spires (96) comportant chacune un enroulement extrême (100) faisant saillie des côtés opposés dudit noyau (26) et comportant chacune une partie de liaison (102) pour inverser le sens dudit enroulement (100); une paire d'ensembles couvercles latéraux (30) s'étendant le long dudit noyau (26) de chaque côté de celui-ci et renfermant ledit enroulement extrême (100); et des moyens (183, 196, 198) pour refroidir l'enroulement de moteur (28), caractérisé en ce que les moyens de refroidissement comportent une pluralité de ventilateurs (183) situés de part et d'autre dudit noyau (26) et à l'extérieur de celui-ci pour diriger l'air à travers lesdits ensembles couvercles latéraux (30) pour refroidir ledit enroulement extrême (100).

2. Un élément primaire selon la revendication 1, dans lequel des moyens déflecteurs (194) sont situés entre ledit enroulement extrême (100) et lesdits couvercles latéraux (30) pour diriger l'air de refroidissement entre les enroulements extrêmes adjacents (100).

3. Un élément primaire selon la revendication 2, dans lequel lesdits ventilateurs (183) dirigent l'air de refroidissement d'un côté d'un couvercle respectif (30) à l'autre côté, et des moyens de sortie (152) sont prévus sur ledit autre côté pour permettre la sortie de l'air de refroidissement.

4. Un élément primaire selon la revendication 3, dans lequel chacun desdits moyens de sortie (152) est situé à l'opposé desdits ventilateurs (183).

5. Un élément primaire selon la revendication 3, dans lequel ledit noyau est situé entre une paire d'éléments de bâti (32) et chacun desdits ensembles couvercles latéraux (30) est supporté sur un ensemble support en équerre (72) s'étendant transversalement à partir desdits éléments de bâti (32).

6. Un élément primaire selon la revendication 5, dans lequel lesdits ventilateurs (183) sont supportés par lesdits ensembles de supports en équerre (72).

7. Un élément primaire selon la revendication 6, dans lequel chacun desdits ensembles couvercles latéraux (30) comporte un premier (126) et un second (124) éléments, chacun desdits éléments (126, 124) présentant un bord qui se termine en adjacence audit noyau (26) et un bord opposé supporté par ledit ensemble support en équerre (72).

8. Un élément primaire selon la revendication 7, dans lequel lesdits ventilateurs (183) sont montés sur ledit premier élément (126).

9. Un élément primaire selon la revendication 8, dans lequel des ouvertures de sortie (152) sont prévues sur lesdits seconds éléments (124) pour permettre la sortie de l'air hors desdits couvercles latéraux (30).

10. Un élément primaire selon la revendication 9, dans lequel lesdites ouvertures de sortie (152) sont à l'opposé desdits ventilateurs (183).

11. Un élément primaire selon la revendication 10, dans lequel ledit ensemble de support en

équerre (72) comporte un raidisseur (80) s'étendant d'une manière générale parallèlement auxdits éléments de bâti (32) et espacé de ceux-ci et lesdits bords opposés sont reliés audit raidisseur.

12. Un élément primaire selon la revendication 11, dans lequel lesdits moyens défecteurs (194) sont assujettis à l'intérieure dudit second élément (124) et s'étendent d'une manière générale parallèlement audit élément de bâti (32).

13. Un élément primaire selon la revendication 11, dans lequel ledit raidisseur (80) est relié audit élément de bâti (32) par des poutres transversales et un élément de support (84) s'étend entre lesdites poutres dans l'ensemble parallèlement auxdits éléments de bâti (32), ledit enroulement extrême (100) desdites spire (96) étant relié audit élément support (84) entre ses extrémités.

14. Un élément primaire selon la revendication 2, dans lequel d'autres ventilateurs (196, 198) sont prévus au voisinage dudit noyau (26) pour diriger l'air sur ledit noyau.

15. Un élément primaire selon la revendication 14, dans lequel ledit noyau (26) est supporté par une paire d'éléments de bâti (32) et lesdits autres ventilateurs (196, 198) sont disposés entre lesdits éléments de bâti.

16. Un élément primaire (16) pour un moteur linéaire à induction comportant un bâti (24) présentant une paire d'éléments de bâti espacés parallèles, un noyau (26) situé entre lesdits éléments de bâti (32) et supporté par ceux-ci, un enroulement moteur (28) porté par ledit noyau (26) et comportant une pluralité de spires (96) espacées le long dudit noyau (26) et s'étendant transversalement à celui-ci, chacune desdites spires (96) comportant une paire de parties parallèles (98) supportées par ledit noyau (26) et interconnectées par un enroulement d'extrémité (100) faisant saillie au-delà dudit noyau (26) de part et d'autre de celui-ci et comportant une partie de liaison (102) d'inversion de sens, une paire d'ensembles couvercles latéraux (30) s'étendant le long dudit noyau (26) de part et d'autre de celui-ci pour recouvrir lesdits enroulements extrêmes (100), et des moyens de refroidissement (183, 196, 198) pour refroidir lesdits noyau (26) et enroule-

ment (28), caractérisé en ce que lesdits moyens de refroidissement comportent un premier ensemble d'éléments de refroidissement (196, 198) situés entre lesdits éléments de bâti (32) pour extraire la chaleur dudit noyau (26), et un second ensemble d'éléments de refroidissement (183) situé à l'extérieure desdits éléments de bâti (32) et de chaque côté de ceux-ci pour extraire la chaleur desdits enroulements extrêmes (100).

17. Un élément primaire selon la revendication 16, dans lequel ledit second ensemble d'éléments de refroidissement comporte un ventilateur (183) pour diriger un courant d'air de refroidissement à l'intérieure de chacun desdits ensembles couvercles latéraux (30).

18. Un élément primaire selon la revendication 17, dans lequel chaque élément couvercle latéral (30) comporte une entrée d'air (184) et une sortie d'air (152) sur ses parties opposées, et ledit ventilateur (183) fait passer l'air depuis ladite entrée (184), à travers ledit enroulement extrême (100), jusqu'à ladite sortie.

19. Un élément primaire selon la revendication 18, dans lequel des moyens défecteurs (194) sont situés à l'intérieure de chacun desdits ensembles couvercles latéraux (30) pour diriger l'air à travers ledit enroulement extrême (100).

20. Un élément primaire selon la revendication 18, dans lequel une pluralité de ventilateurs (183) sont disposés de chaque côté dudit noyau.

21. Un élément primaire selon la revendication (20), dans lequel lesdits ventilateurs (183) sont montés sur une première partie (126) dudit ensemble couvercle latéral (30), et ladite sortie (152) est montée sur une seconde partie (124) dudit couvercle latéral, un ensemble de supports en équerre (72) étant prévu sur lesdits éléments de bâti (32) pour relier lesdites première et seconde parties à l'extérieur dudit enroulement extrême (100).

22. Un élément primaire selon l'une quelconque des revendications 16 à 21, dans lequel le noyau (26) présente une surface inférieure comportant une pluralité de rainures transversales pour recevoir lesdites parties parallèles (98) des spires d'enroulement (96).

50

55

60

65

8



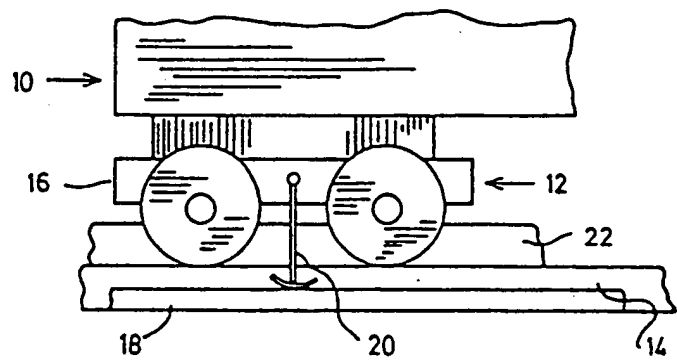


FIG. 1

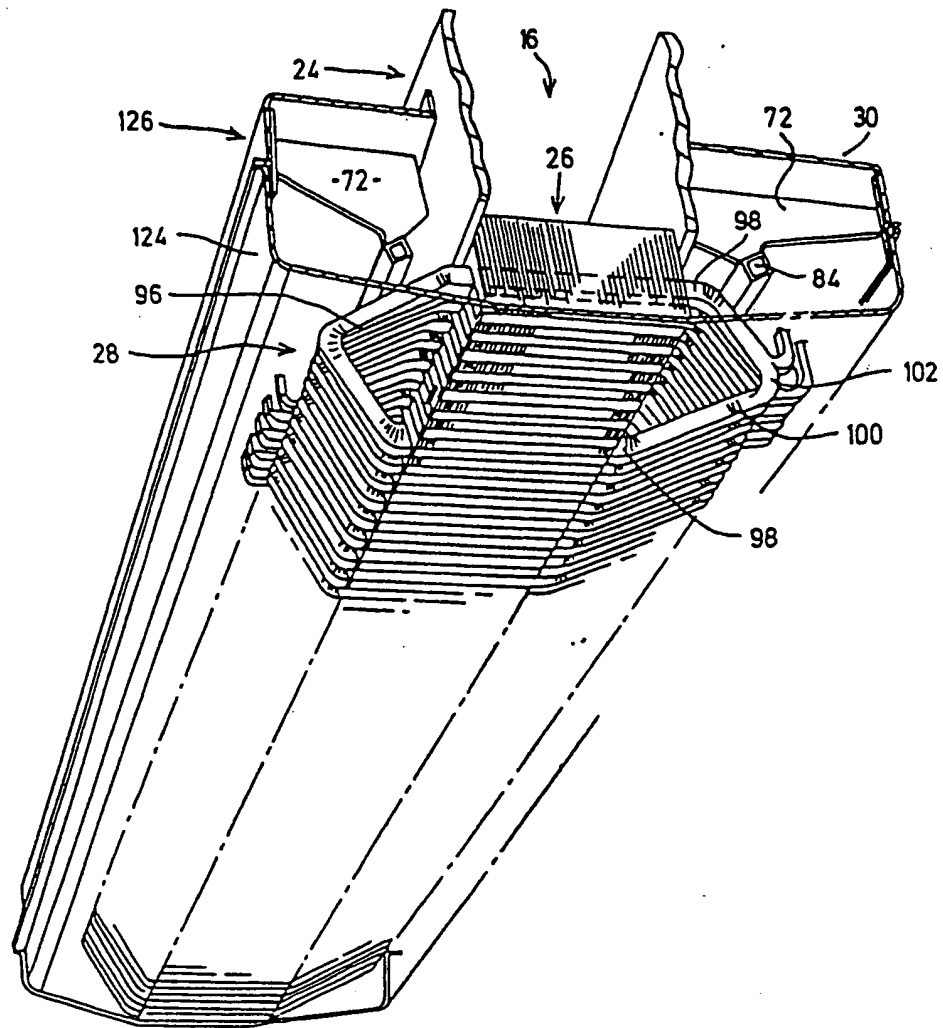


FIG. 2.

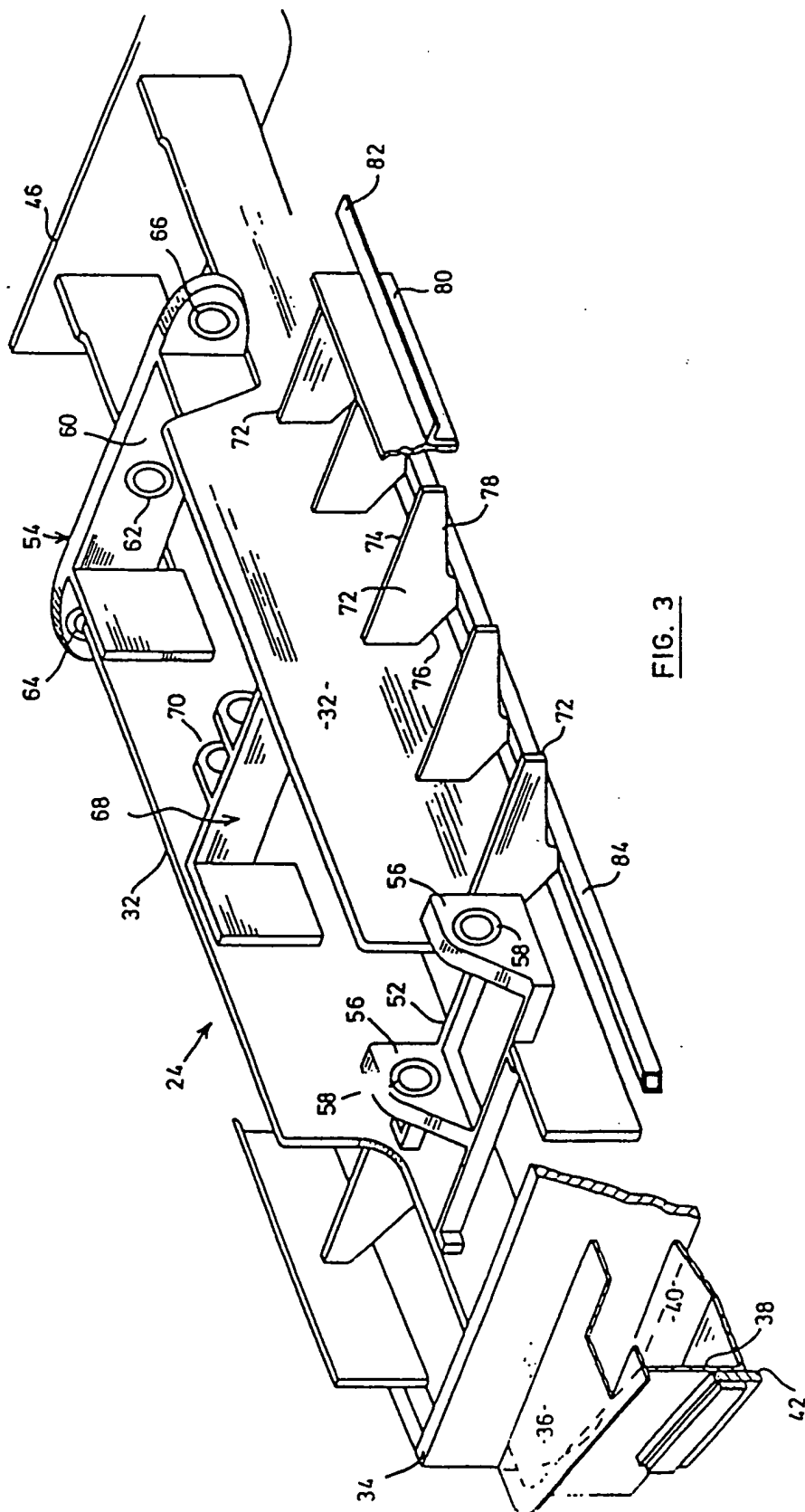
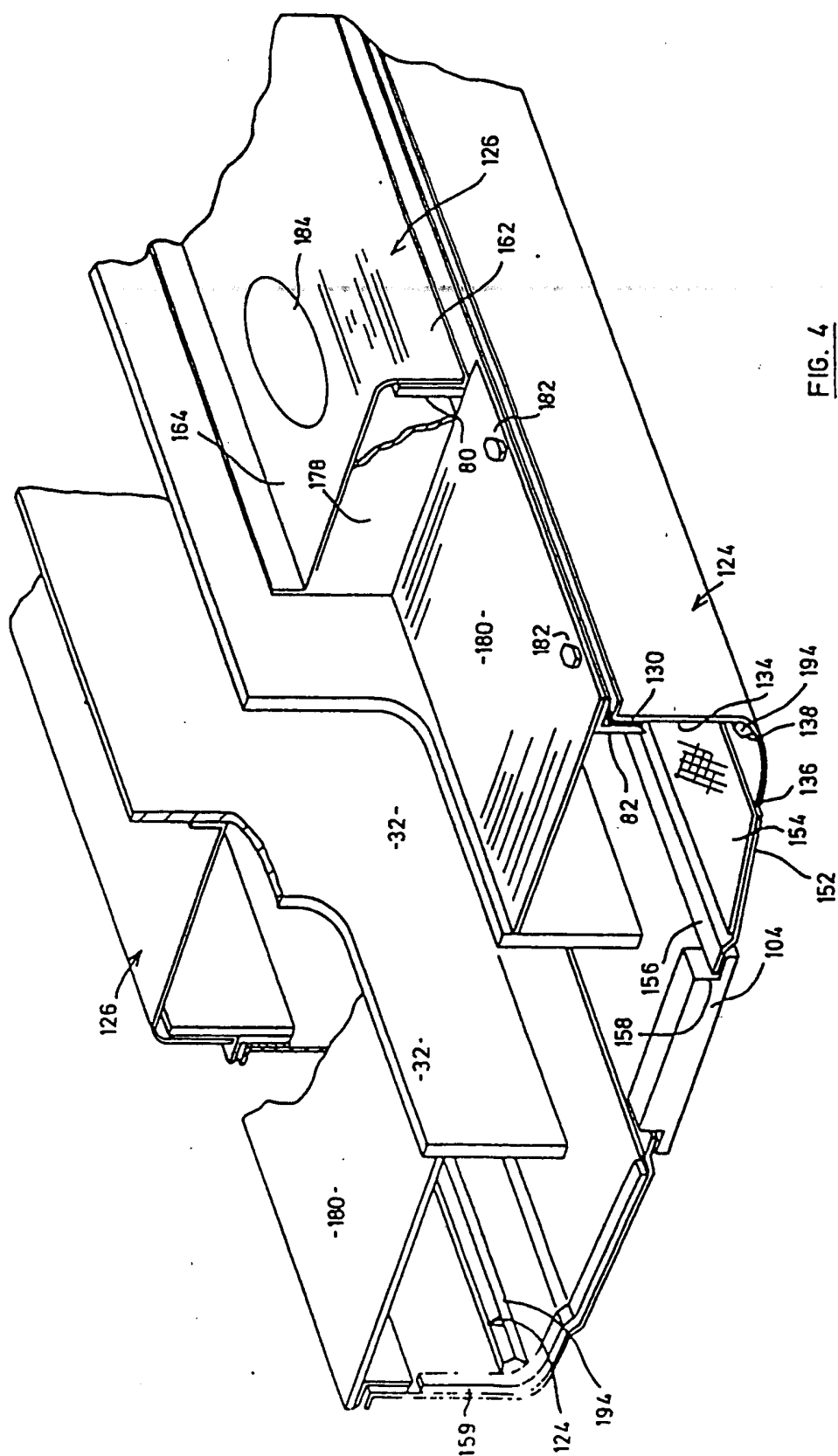
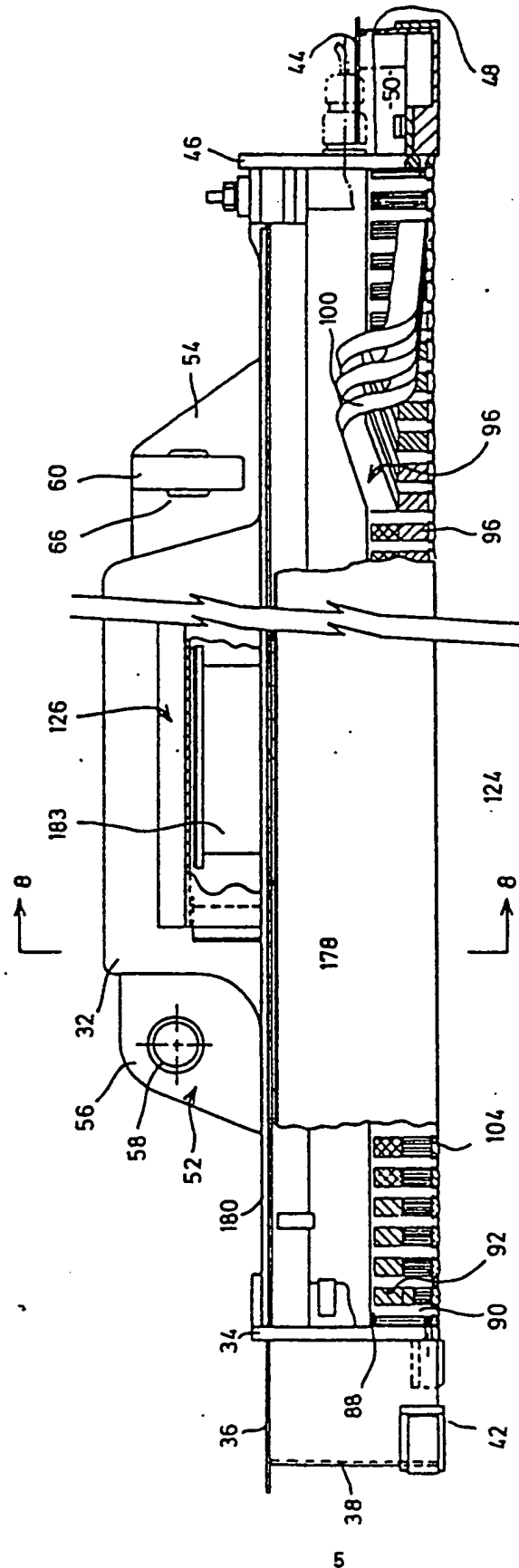


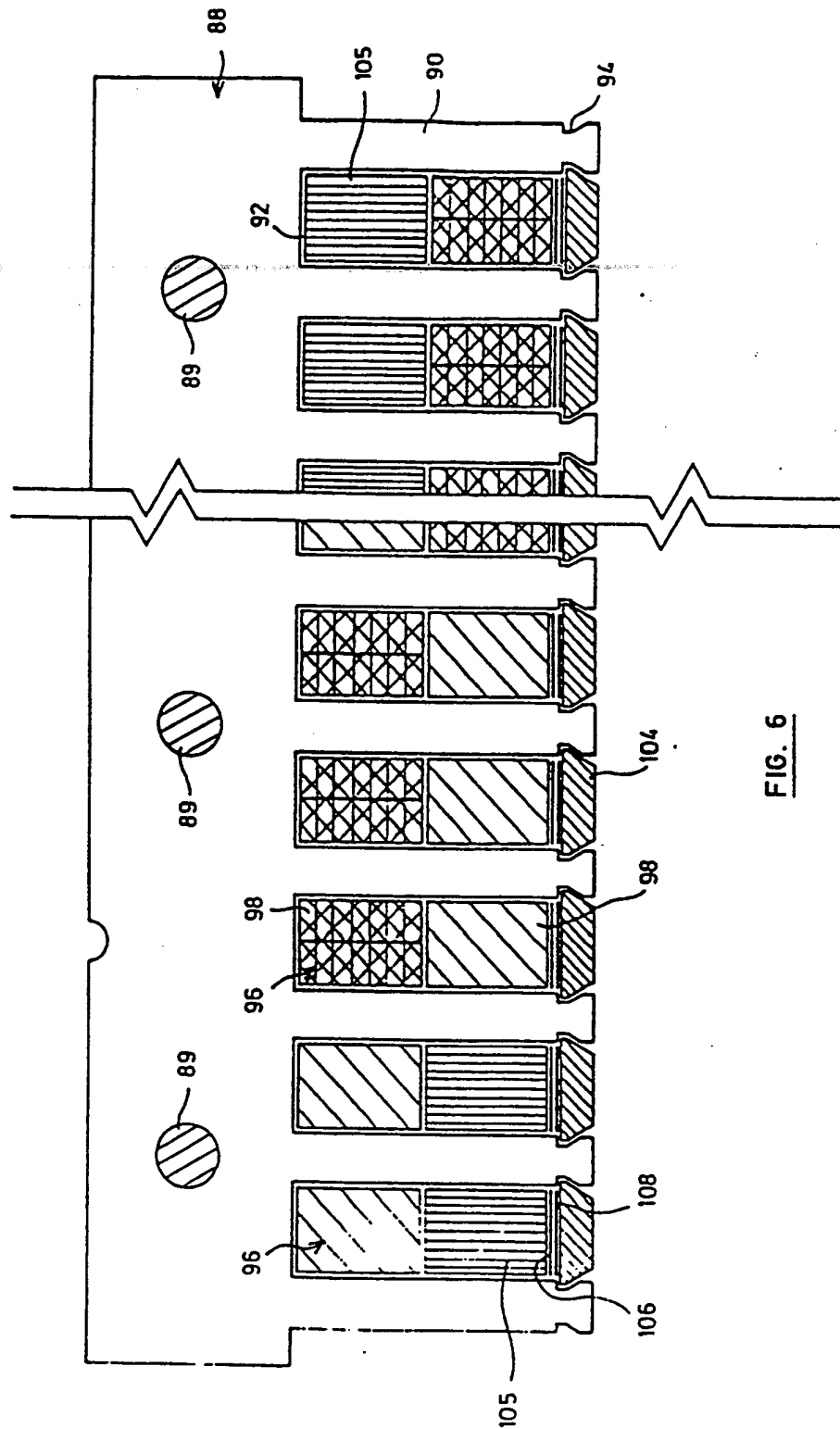
FIG. 3



7.913



**FIG. 5**



**FIG. 6**

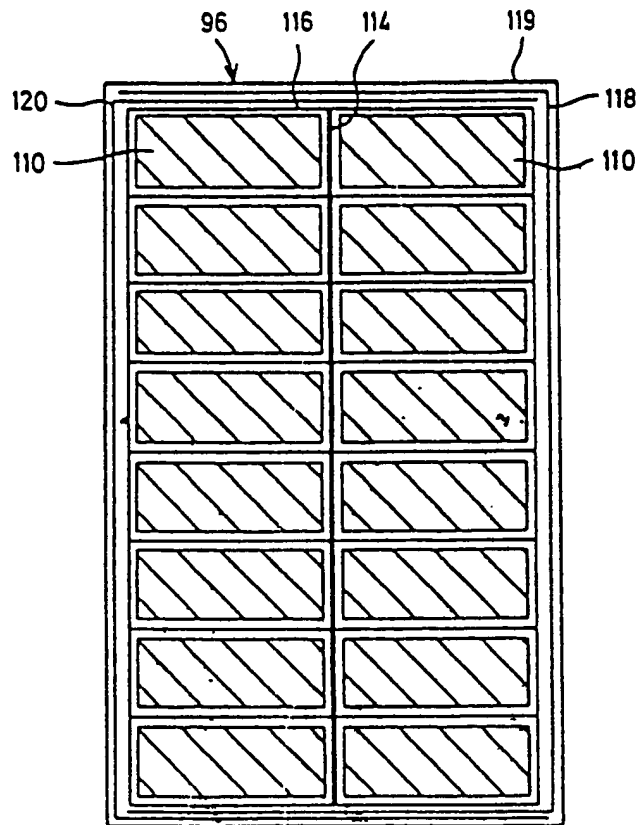


FIG. 7

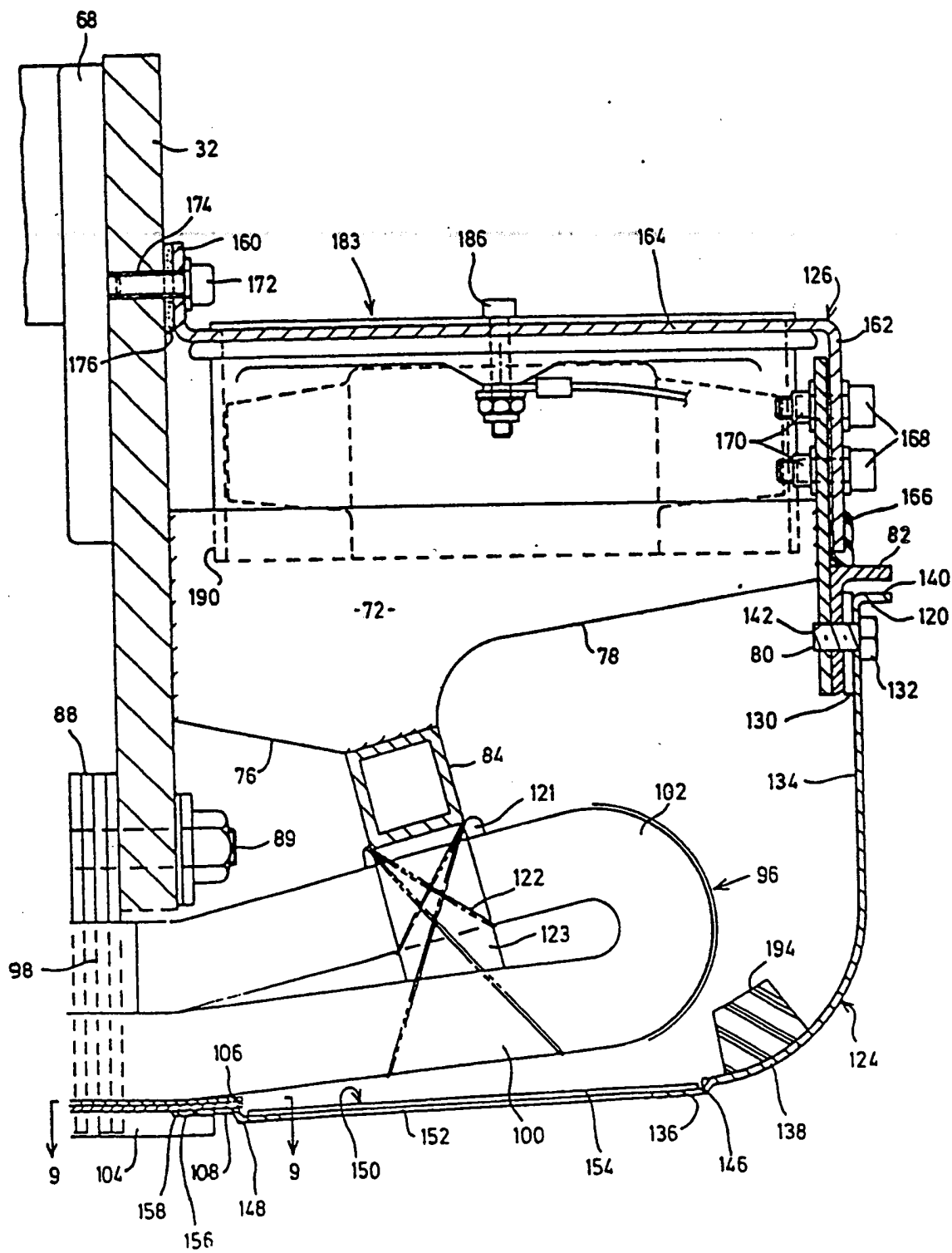


FIG. 8



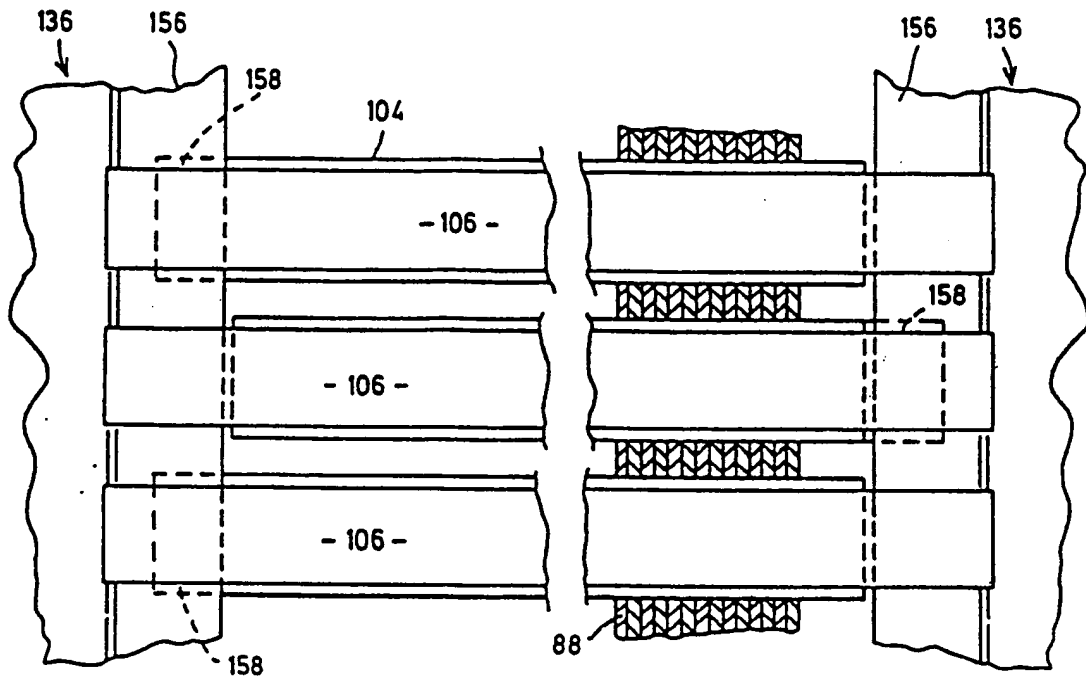
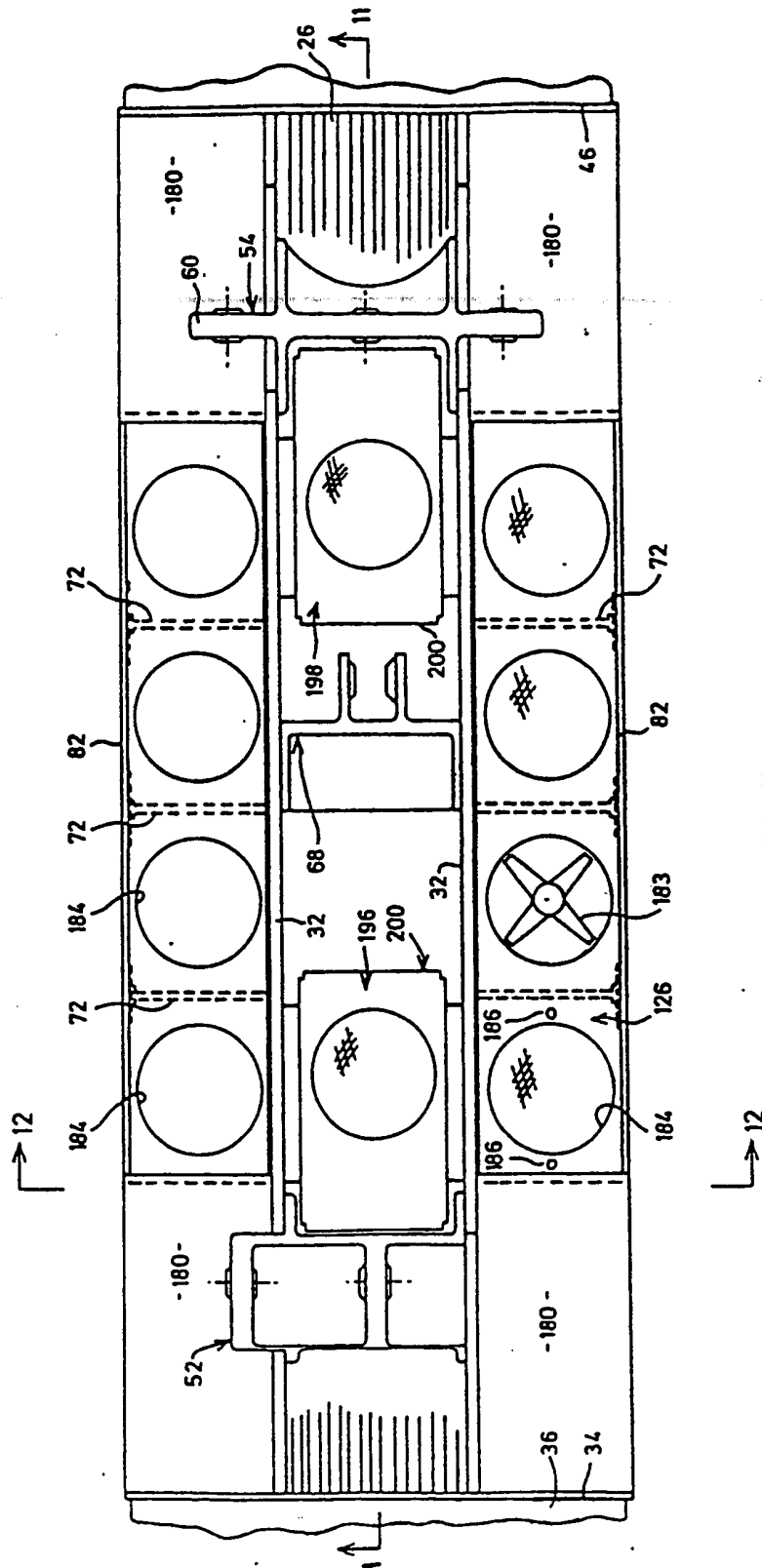


FIG. 9



**FIG. 10**

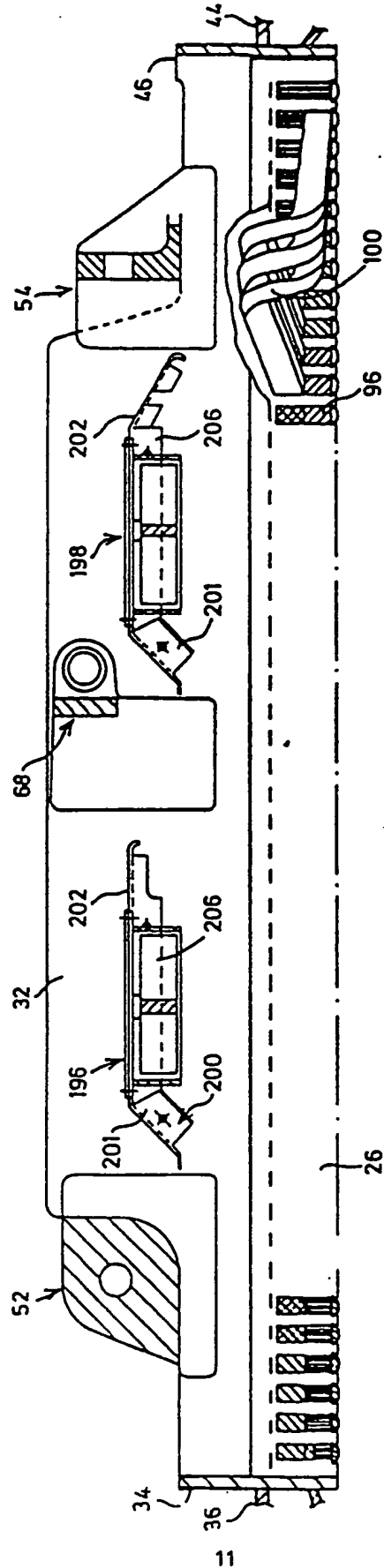


FIG. 11

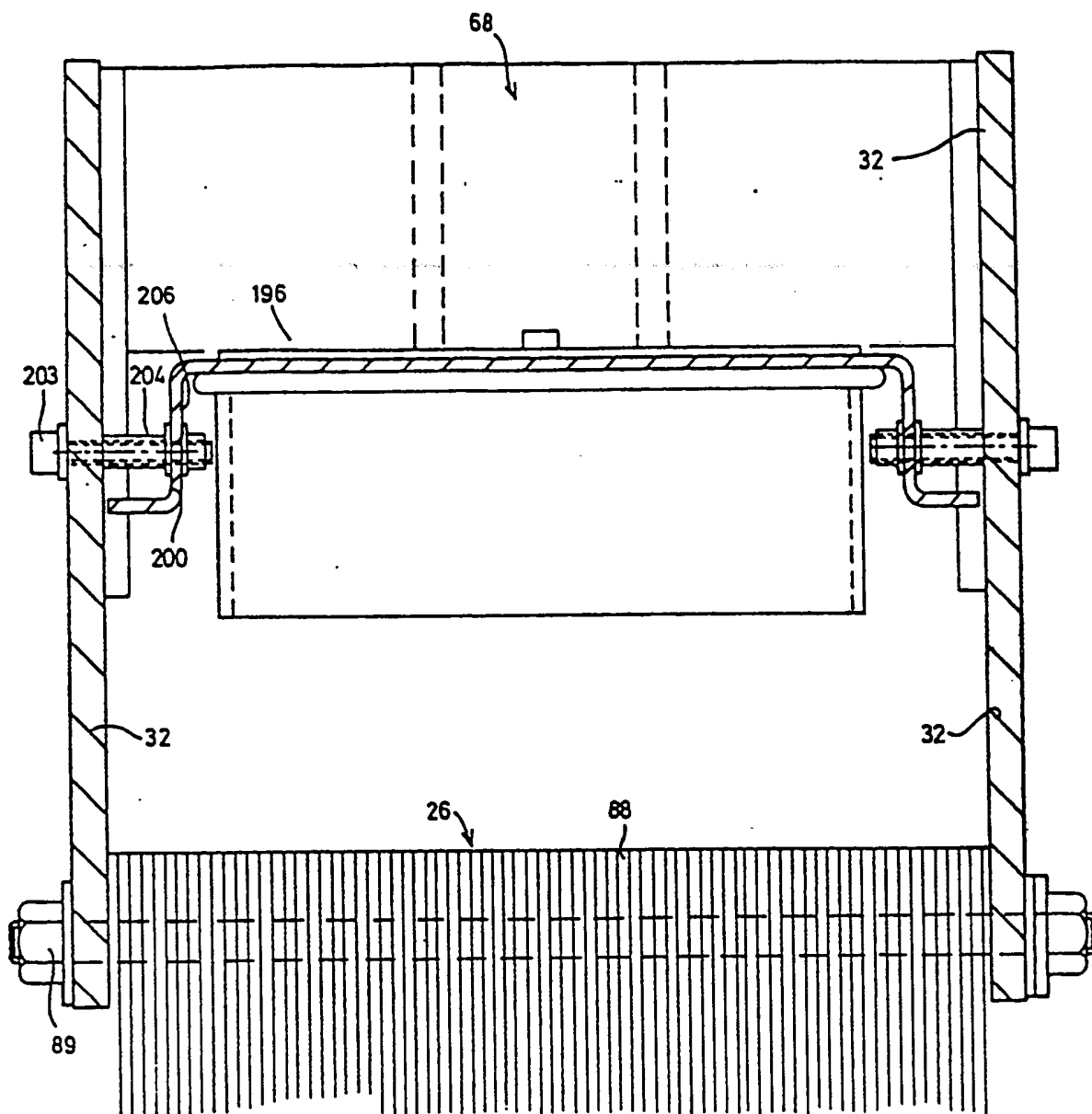


FIG. 12